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TRANSPORTATION

No. 71

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RAILROAD

ELECTRIFICATION PLAN FULFILLMENT EXAMINED BY RAILWAYS MINISTRY

Moscow GUDOK in Russian 1 Dec 81 p 2

[Article: "Underway Electrification Projects to Be Turned over On Schedule"]

[Text] The board of the Ministry of Railways has reviewed the fulfillment of the plan and the work done for putting in operation in 1981 the projects for electrification of railroads.

For capital construction in connection with the electrification and power engineering work the level of development of the capital allocated in the current year is somewhat higher than last year. Many of the enterprises of the railroads are giving considerable aid to the contract organizations in installation and adjustment of a contact net and equipment for the traction substations and STsB [signalization, centralization and blocking] and communications devices and in fulfillment of a number of other jobs.

At the same time, in some sectors the proper steps have not been taken to put installations into operation on time. An especially bad situation has developed in the underway projects of the Bira-Arkhara sector of the Far East Railroad, the Karaganda-Mointy sector of the Alma-Ata Railroad and the Orsk-Orenburg sector of the South Ural Railroad.

The executives of these roads have not taken the proper measures to achieve on-schedule development of the work for electrification of the sectors in the current year.

An unsatisfactory pace is being maintained in the work on the underway projects of the Krivoy Rog-Dolinskaya sector of the Pridneprovsk Railroad and the Yanaul-Yudino sector of the Gor'kiy Railroad, where in 10 months only 41.1 and 32.7 percent respectively of the yearly plan for capital investments was put into operation.

The board asked that all the necessary measures be taken for completion of the work of electrifying the roads in 1981 so as to make sure that all the sectors are put into operation.

The chiefs of the Far Eastern, Alma-Ata and South Ural roads were ordered to exercise personal control over the progress of the ongoing work of electrification in the Arkhara-Bira, Karaganda-Mointy, and Orsk-Orenburg sectors, to operationally

provide the necessary help for the contract organizations, and to provide for the efficient scheduling and effective use of the "windows." It is essential to immediately staff all the underway projects with operational personnel and to provide for prompt training of all the organizations for the electric traction work of the sectors. Before 15 December they must complete delivery to the projects of the lacking equipment for installation of the traction substations and the StsB and communications devices. Provision has also been made for other measures designed for putting the electrification projects into operation in the current year.

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BRIEFS

INCENTIVE INCREASES--The Goskomtsen [State Committee for Prices] USSR established incentive markups on the wholesale price for tank car model 15-1565 for the transport of sulfonmethane. The new tank car, made from stainless steel, as compared to model 15-1417, which it replaces, has a 15 instead of a 6-year service life before capital repair, its freight capacity is increased from 53.7 to 62.0 tons and its weight is down from 27.2 to 26.0 tons. On the basis of an estimate of the economic effect an incentive markup of 1800 rubles on the wholesale price has been approved for tank car model 15-1565. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44 Oct 81 p 7]

IMPROVING AGRICULTURAL SHIPMENTS--"Measures Are Being Taken"--Under the heading "How the Vegetable Conveyor is Faring" (EG[EKONOMICHESKAYA GAZETA[No 27) published correspondence dealing with the transport of vegetables. On the instructions of the Council of Ministers USSR the matter of the application of new methods of transporting early cabbages and other fruits and vegetables in boxes was reviewed in the Gosstandart [State Committee for Standards] with the participation of all the concerned ministries and departments. It was decided to ship the products in compact stacks at a load height of 200-240 centimeters. At the same time, it should be noted that the use of specialized containers (box trays) for the shipment of melon crops, vegetables and fruits is being delayed because of the shortage of containers of this type, the imperfections in the design of the containers, etc. The USSR Ministry of Railways [MPS], and the concerned ministries and departments are taking measures to improve the shipments of agricultural products. [Signed] V. Gin'ko, Deputy Minister of MPS. [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 44 Oct 81 p 17]

IMPROVEMENTS IN THE METRO--"The Future of Our Metro"--In the conference hall of the Main Administration of Metros there was held a meeting between Deputy Minister of Railways B. A. Shelkov and newspapermen. Discussing the outlook for the development of the metros in the USSR, the deputy minister noted that in the current five-year plan the extent of the underground lines will increase by more than 100 kilometers and in the capital by 29.4 kilometers. In Moscow the metro plays a particularly appreciable role. In the morning hours the metro transports 56 percent of all the passengers in the capital. In one hour alone, from 8 to 9, the particularly busy lines handle up to 15 percent of their daily transportation load and each car carries more than 240 passengers instead of 170 in the norm. All this will determine the intensiveness of the development of the metro in the

next 10 years. In 1983 alone eight new stations will appear on the map of the city metro. This same five-year plan will include the completion of the basic planning work and the beginning of construction of the Timiryazevskiy radius. The plan calls for extending it in 1986 from the Library imeni Lenin to the Chekhov Library and by 1987 from the Chekhov to the Savelovskiy and Otradnyy. In prospect is work for automation and mechanization of the metro, work which has already enabled us in some sectors to shorten the intervals between trains to the optimum time of 80 seconds. We are testing an improved new type of metro car which is characterized by comfort, more space, a smooth ride, and a modern automated control system. In the closing period of this five-year plan we will test the first train consisting of 14 of these cars, after which series production of them will begin. [Text] [Moscow MOSKOVSKAYA PRAVDA in Russian 1 Nov 81 p 3]

ADVANCES IN LOCOMOTIVE DESIGN--The new TEM-7 switching diesel locomotive has twice the power of the previous models. It was developed at the Lyudinovo Locomotive-Building Plant, which will begin series production of these locomotives. The capacity of the TEM-7 is 2,000 horsepower. At the large railroad centers it can be used to form trains weighing up to 8,000 tons. The designers have begun work for the solution of a future problem--the development in the 11th Five-Year Plan of the 3,000-horse power TEM-8 locomotive, which will be used on the BAM [Baykal-Amur Mainline]. The enterprises have completed the development of the technical assignment for this locomotive.--(TASS) Kaluzhskaya Oblast. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 20 Mar 81 p 17]

NEW RAILROAD LINE--Surveying work has begun at the site of the future Berkakit-Tommot-Yakutsk railroad line, which will connect the capital of Yakutiya with the BAM [Baykal-Amur Mainline]. The steel track will cut through the high mountain of the Aldanskoye Nagor'e [Highland] and proceed over the Aldan, Amga and Lena rivers. [Text] [EKONOMICHESKAYA GAZETA in Russian No 24, Jun 81 p 3]

RAILROAD BRIDGE INSTALLATION--Mostostroy [Bridge Construction] Trust-10 has begun installation of the spans of the railroad bridge over the Olekma River. It will be the largest water crossing in the central sector of the BAM [Baykal-Amur Mainline] [Text] [Moscow EKONOMICHESKAYA GAZETA in Russian No 29, Jul 81 p 3]

NEW LINE INAUGURATED--Arriving at the same time at station Myyzakyula, which is at the border of two Baltic republics, were two passenger trains from Riga and Tallinn. The trains were decorated with placards and flags. Arriving here were government delegations from Latvia and Estonia, transport construction officials, and railroad personnel of the Baltic Mainline Railroad. It was the gala opening of the new Riga-Tallinn railroad line, which is nearly 90 kilometers shorter than the route which existed previously. The new line has shortened the route between the Baltic ports, has linked them with each other, and has connected the western regions of the two republics with the country's network. It will further the future development of industry and agriculture in this region. [Signed] L. Lyubimov, GUDOK correspondent, Riga--[Excerpts] [Moscow GUDOK in Russian 22 Jul 81 p 1]

INCREASED RELIABILITY OF WHEELS--The All-Union scientific research institutes of railroad transport, ferrous metallurgy and railroad-car building have worked out a new standard--"Seamless Rolled Wheels. Technical Requirements." Unlike the

existing one, the new standard prescribes the use of two brands of steel for wheels--one for passenger cars and the other for the wheels of freight cars. This steel is characterized by resistance to wear and tear and increased strength characteristics. Provision has been made for a check of the uniformity of the hardness along the perimeter of the wheels. We have introduced a mandatory determination of the impact strength of the metal of the wheel discs for the first and second brands of wheels under a temperature of +20 degrees and a mandatory check of the macrostructure. When the results of the mechanical and hardness drop tests are unsatisfactory, we institute monitoring of contamination of the steel by nonmetallic impurities. [Text] [Moscow GUDOK in Russian 15 Aug 81 p 3]

IMPROVEMENT OF TRANSPORT WORK--The rhythmic work of industry is to a considerable degree dependent on efficient operation of the industrial transport of the enterprises and the interrelationships between this transport and the railroads and the mainline motor transport. The relevant fleet of the plants, factories and combines is constantly being replenished with new powerful equipment. Thus, all the nonferrous metallurgy enterprises have fully converted to diesel locomotive and electric locomotive traction. Nearly 80 percent of the motor vehicle shipments are carried out in this sector by heavy trucks. The intraplant transport network has obtained further development. Many collectives of industry and transport are operating on the basis of a common schedule of cooperation. On 12 October Alma-Ata was the scene of the beginning of the work of the All-Union conference on "Ways of Improving the Work of Industrial Transport and its Interrelationships with Mainline Transport." The conference was opened by Professor A. M. Makarochkin, chairman of the Transport Committee of the All-Union Council of Scientific-Technical Societies. Participating in the work of the conference was Kazakh SSR Council of Ministers Chairman K. D. Kobzhasarov and the executives of a number of ministries and departments. (KazTAG [Kazakh News Agency]). [Text] [Alma-Ata KAZAKHSTANSKAYA PRAVDA in Russian 13 Oct 81 p 3]

RAIL DEFECT FINDER--With the participation of the design office of the Main Administration of Signalization and Communications of the MPS [Ministry of Railways], the department of transport defect finding of the VNIIZhT [All-Union Scientific Research Institute of Railroad Transportation] developed a new magneto-ferrosound rail defectoscope, the MD-22FR. It possesses improved technological and operational qualities. Its sensitivity is 20 percent greater than that of the existing defectoscopes. The new defectoscope has four independent magnetic control channels for the inner and outer edges of the rails. An additional ultrasonic channel has been put in for rechecking of seriously defective rails. The economic effect of the introduction of these defectoscopes results from increased reliability of the control and reduction of the probability of potential damages. [Signed] V. Antonov. [Text] [Moscow GUDOK in Russian 11 Nov 81 p 2]

NEW ARMENIAN RAILROAD--Yesterday saw the beginning of operation of the new Masis-Nurnus railroad mainline, about 50 kilometers long. The new railroad shortens considerably the journey from the capital of Armenia to the rapidly developing Razdan-Sevan industrial zone of the republic. Its operation is accelerating the transport of freight and output from the sovkhozes and kolkhozes of the Ararat valley. [Signed] V. Shakhnazaryan, Station Masis, Armenian SSR. [Excerpts] [Moscow TRUD in Russian 4 Nov 81 p 2]

KUZBAS CONSTRUCTION PROJECTS--Reconstruction of the Artyshta-Tomusinskaya sector is the basic project of the Kuzbasstransstroy [Kuzbas Transport Construction] Trust and one of the most important projects in the Kuzbas. The first section--125 kilometers of one-track road--was built by the collective a long time ago in uninhabited areas. This year another 26.6 kilometers are to be put into operation. Slated for opening in the future is a direct route from Central Siberia to Mezhdurechensk. [Excerpt] [Moscow GUDOK in Russian 16 Oct 81 p 1]

RAILROAD TO YAKUTSK--The Congress took our suggestion into account. The "Basic Directions" includes "To prepare a technical and economic substantiation for development of the iron ore deposits in southern Yakutiya and for construction of a Berkakit-Tommot-Yakutsk railroad line. The railroad to Yakutsk is a particularly important project. The republic's contribution to the country's economic development would be more substantial if the transport problem were resolved. The rapidly increasing flow of goods cannot be handled by the seasonal river transport. Because of the lack of good roads, the extremely long duration of the journey of the freight, and the limited potential of air and motor vehicle transport, the national economy is suffering an enormous loss. The advent of a railroad to Yakutsk is playing a truly revolutionizing role in the development of the productive forces in this region of the country, is accelerating social development in a vast territory, and hence will have enormous consequences. Henceforth everyone will have to work hard so that the road will be built on time and with minimum costs. In this stage we are assigning to the expedition of Mosgiprotrans [Moscow State Planning and Surveying Institute for Transportation Construction] the task of creating all the conditions for successful work so that the compilation of the TEO [technical and economic substantiation] will be completed in 1982. [Excerpts] [Moscow EKONOMICHESKAYA GAZETA in Russian No 36 Sep 81 p 5]

PASSENGER LOCOMOTIVE TESTED--"Improved Transport Equipment--The TEP75 Taking Tests"--Since last year the experienced machine specialists of the Leningrad-Warsaw depot, in collaboration with the machine builders from Kolomna, have been studying the "behavior" of the first output of the TEP75 series passenger diesel locomotive. The capacity of the new vehicle is 6,000 horse power. The designed speed is 160 km per hour. It can pull a train made up of 20-22 cars. Despite the fact that its axle load is two tons more than its predecessor, the permissible speed of movement on the ruling gradient is the same. This is above all indicative of the highly dynamic properties of the new vehicle. [Excerpts] [Moscow GUDOK in Russian 22 Oct 81 p 2]

COMPUTER CONTROL OF TRAINS--Imagine you are standing on the Moscow vicinity platform of Fryazino where you are waiting for a train. Suddenly you see a train coming but it is proceeding on its own without an engineer. It stops where it is supposed to, neither nearer nor further, it opens its doors, picks up the passengers, and continues on its way. A voice on radio announces the stops and does not get mixed up as to which comes after which. Fantastic? No. A real perspective. The associates of the scientific research institute of railroad transport recently conducted tests on an experimental circuit in Shcherbinka near Moscow. The electric locomotive was given commands by an electronic computer located at the institute dozens of kilometers distant. The electric locomotive started, braked and stopped at the planned points; it obeyed 26 commands in all. The

experimental introduction of electronic computers on the capital railroad will be carried out in two stages, according to Doctor of Technical Sciences Yevgeniy Tishkin. At first the electronic equipment will assist the dispatchers. And then, in the more distant future it will take over the direction of the trains. It is planned to make the country's first use of the innovation in the sector of busiest train traffic--Moscow--Aleksandrov. [Signed] L. Solntseva. APN [Novosti Press Agency]. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Nov 81 p 4]

BAM (BAYKAL-AMUR-MAINLINE) CONSTRUCTION--Ukrainian construction workers are building the city of Urgal on the BAM in Verkhneburetsenskiy Rayon, Khabarovskiy Kray. Along with the Kiev and Khar'kov people and envoys from other oblasts of the republic, Donbass personnel have been at work here for seven years now. In this time dozens of residential buildings have sprung up in the taiga, housing several thousand BAM workers--KOMSOMOLETS DONBASSA (Donetsk)--[Text] [Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 11, 1981, p 2] 7962

BAM CONSTRUCTION SPECIALISTS--About 2,500 construction workers of the eastern sector of BAM received certificates as drivers of large dump trucks, bulldozers and excavators. The first graduate group of skilled specialists for the construction project was trained this year by DOSAAF [All-Union Voluntary Society for Assistance to the USSR Army, Navy and Air Force] organizations of the kray. In the zone of the route of the northern Trans-Siberian Railway seven of the society's sports and technical clubs are in operation. They have organized their branches in Urengoy, Berezovo, Soloni and other settlements of the railroad--ZABAYKAL'SKIY RABOCHIY (Chita)--[Text] [Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 11, 1981, p 2] 7962

RAILROAD CONSTRUCTION IMPROVEMENTS--The processes developed by the SibTsNIIS [Siberian All-Union Scientific Research Institute of Transportation Construction] are widely used in the construction of the BAM and the Surgut-Urengoy railroad line. These developments comprise primarily the columnar foundations of bridges, water pipes made from corrugated metal, the technology for the building of a soil bed by the hydromechanical method, and other developments. According to the figures of the construction people the use of these developments is resulting in a yearly saving of 5-6 million rubles.--SOVETSKAYA SIBIR' (Novosibirsk)--[Text] [Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 11, 1981, p 2] 7962

BAM LABOR FORCE--More than 60 percent of the workers and office workers of the BAM intend to work until the construction is completed. This is the chief conclusion stemming from the social survey carried out by the Glavbamstroy [Main Administration for BAM Construction], the Dorprofsozh [railroad trade unions] of transport construction workers, and the headquarters of the BAM Komsomol Central Committee. The results of the survey are being used in preparing measures for assigning skilled personnel on the construction project.--AMURSKAYA PRAVDA (Blagoveshchensk)--[Text] [Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 11, 1981, p 4] 7962

INSPECTION OF BAM STRUCTURES--A laboratory car of the Scientific Research Institute of Bridges has been proceeding along the route of the Baykal-Amur Mainline. The scientists have been doing research on the BAM for six years. On the current trip the specialists are focusing particular attention on inspection of the underwater parts of the bridges and determination of the effect of low temperatures on the concrete structures. The recommendations of the scientists will enable them to increase the dependability of the structures.--VECHERNIY LENINGRAD.--[Text] [Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 11, 1981, p 4] 7962

BAM CONSTRUCTION WORK--Eighteen construction personnel of the SSMP [expansion unknown] of the Gruzbamstroy [Georgian BAM Construction Trust] have landed at the site of the future station of Chekab'ya, which is located in the Charsk valley of Chitinskaya Oblast. "The Georgian construction workers have pledged themselves to be the first to turn over a permanent settlement for the railroad workers and to handle this commitment with honor," says the chief of the SSMP of Gruzbamstroy, A. V. Dvalishvili, "but our endeavors on the BAM land do not end with this. We have undertaken the job of looking after one other settlement. The first landing has been made. The settlement is being readied for receiving the rest of the construction workers. Working in the construction of Chekab'ya will be experienced, trained construction workers from Georgian scientific research institutes.--STROITEL' BAM (Bratsk)--[Text] [Moscow TRANSPORTNOYE STROITEL'STVO in Russian No 11, 1981 p 18] 7962

ELECTRIFIED LINES--"From Moscow to Minsk"--The state commission has approved the use of the Orsha-Borisov railroad sector following its remodeling and conversion to electric traction. Thus, the entire 700-kilometer railroad line from Moscow to Minsk has been electrified. The speed of the electric passenger trains will increase to 140 kilometers an hour. And after the remodeling of the Minsk freight station the electric trains will also transport freight cars. This will enable them first, to increase their weight and second, to step up the turnover of the cars; this will in the long run increase the traffic capacity of the road. Work is now continuing on electrification of the sector of track from Minsk to Brest. It will go into operation by the end of the five-year plan. [Signed] N. Kernoga, Staff Correspondent--[Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 20 Nov 81 p 2] 7962

LOCOMOTIVES FROM CZECHOSLOVAKIA--Fulfillment of the Soviet orders was completed ahead of schedule by the collective of the electric locomotive-building plant of the Skoda Czech association imeni V. I. Lenin in Plzen. In the past months the plant manufactured in all 70 electric locomotives of various types. Skoda shops are now carrying out assembly of locomotives for 1982. (TASS photograph of locomotive appended). [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 20 Nov 81 p 3] 7962

CARS FOR THE BAM--Several days ago 12 railroad passenger cars, manufactured by the Kalinin Railroad Car Building Plant imeni M. I. Kalinin, were accepted and sent to the Baykal-Amur Mainline. This railroad car model was recently completed and improved by plant specialists and a great deal of additional comfort has been added for the passengers. It is proposed that two passenger trains, made up of the Kalinin cars, will travel the Lena-Kunerma sector, which was opened in late October of this year. [Text] [Moscow SEL'SKAYA ZHIZN' in Russian 10 Nov 81 p 1]
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NUCLEAR REACTORS ON BOARD ICEBREAKERS

Moscow MORSKOY FLOT in Russian No 10, Oct 81 pp 42-46

[Article by L. Danilov, deputy chief, Murmansk Steamship Company: "Operating Experience of Nuclear Icebreakers"]

[Text] It was no fluke happening that the introduction of nuclear energy within the Soviet maritime fleet began with icebreakers. The practical exploitation of the natural riches of the extreme north has been substantially hindered by their separation from the industrial centers of the country in terms of transportation. Provision of reliable large-scale shipments of national economic freight along the national transport network of the Northern Sea Route is only possible through the use of the powerful icebreaker fleet and special-purpose freighters fitted for navigation conditions in Arctic waters. The efficiency of the uninterrupted and dynamic icebreaker support for the reliable and safe passage of freighters is determined by the numbers of and the performance specifications of the icebreakers, particularly their power, displacement, and cruising capacity.

The changes in the volume and type of shipments over the past 25 to 30 years triggered the need for qualitative changes in the icebreaker fleet. Changes in the fuel balance and the growth of the national income made it possible to convert several of the older icebreakers from solid to liquid fuels and to begin the series construction of diesel-electric icebreakers. The shift from steam power systems to diesel-electric ones has resulted in a substantial increase in the effectiveness of the use of the icebreaker fleet and has lightened the workload of the seamen.

Over the past 25 years, diesel-electric icebreakers in six classes have been built: "Vasiliy Pronchishchev" class, powered by 5,400-hp engines (3.97 MW); the 10,500-hp (7.72 MW) class "Kapitan Belousov"; the 22,000-hp (16.20 MW) "Moskva" class; the 35,000-hp (25.74 MW) "Yermak" class; and the 26,000-hp (19.12 MW) "Kapitan Sorokin" class. Construction of each class has been the result of the growing demands of the economy both in the Arctic basin and in those areas with ice-blocked ports.

But even though the power needs of the icebreakers are being solved satisfactorily with the shift from steam to diesel-electric power systems of generally up to 40,000-hp (30 MW), this has no bearing on their cruising capacity. Table 1 contains data on the displacement and fuel reserves for each class of icebreaker.

Table 1.

Icebreaker (type of fossil fuel)	Displacement (thousand tons)	Fuel (thousand tons)	Relationship (%)
"Yermak"-I* (coal)	10.0	2.2	22.0
"Krasin"-I (coal)	10.2	3.1	30.0
"Sibir'"-I (coal)	11.0	3.4	31.0
"Kapitan Belousov" (diesel)	4.5	1.1	24.5
"Moskva" (diesel)	13.3	4.8	36.0
"Yermak"-II (diesel)	20.2	5.7	28.0
"Kapitan Sorokin" (diesel)	14.5	3.5	24.5

*The figure "I" designates a first generation icebreaker and the figure "II" designates a second generation one.

The duties of icebreakers necessitate their being fitted with powerful, highly maneuverable power systems with the ability to safely perform drastic power adjustments during the interaction of the screw with the ice and to support prolonged cruising capacity (in relation to fuel reserves).

The high power potential of nuclear fuel makes it possible to manufacture nuclear power plants of almost unlimited power that do not require fuel reserves, thus increasing the cruising range of the ships and opening broad potential for the growth of their cargo handling capacity and running speed.

Preliminary evaluations of the application of nuclear power systems indicate a potential to increase the cruising capacity of the icebreakers to 200 days based on operations at various power levels, which ensures participation in three Arctic navigation seasons without recharging the reactors.

Table 2 presents data on the anticipated cruising capacity for icebreakers with nuclear steam generating plants, along with data on the achieved cruising range and capacity of icebreakers running on fossil fuels.

Table 2.

Icebreaker	Cruising range, in thousand miles	Cruising capacity, in days
Group I:		
"Sibiryakov" "Kapitan Belousov" "Labrador" (Canada) "Wind" (USA)	8-25	25-60
Group II:		
"Yermak"-I "Krasin"-I "d' Iberville" (Canada)	8-17	35-50
Group III		
"Macdonald" (Canada) "Glacier" (USA) "Gletcher" (USA) "Moskva"	12-20	45-50
Group IV		
"Yermak"-II	16-18	35
"Lenin" (First generation reactor plant)	Unlimited	200
Group V		
"Arktika"	Unlimited	500
"Sibir'"	"	
"Lenin" (Second generation reactor plant)	"	700

Note. The classification of groups is based on comparative performance characteristics: displacement, shaft power, power to weight ratio, screw towing force, and power to beam ratio of the icebreakers. I= first generation icebreaker; II= second generation.

As is evident from the tabulated data, the cruising capacity of the icebreakers using fossil fuels fluctuates between 25 and 50 days. The mutually restricted power and cruising capacity of diesel-electric icebreakers had the greatest conflicting effects when icebreakers were built with light draft for operations in the mouths of the Siberian rivers. The need to systematically replenish an icebreaker's fuel supply creates a constant dependency factor for the timely supply of fuel during the transport process in Arctic areas. In line with the continuous increase in the length of the navigation season (year-round navigation is already occurring in the western Arctic) as well as the growing volume of ship traffic, the impact of this dependency is even more obvious.

A marked qualitative change in the composition of the freighter and icebreaker fleet that operates during the western Arctic navigation season has occurred over the past 20 years. In the face of only a 5 percent increase in the number of ships, the cargo carrying capacity has increased three-fold and the volume of shipments has increased 11-fold. Over the 20-year period, the length of the navigation season increased from 90 to 330 days here, chiefly as a result of increases in the power to weight ratio of the icebreakers (2.7 fold) and in their utilization factor (3.7 fold).

The preparations for the journey of the icrebreaker "Arktika" to the North Pole in August 1977 and the through passage of the icebreaker "Sibir'" with the diesel-electric powered "Kapitan Myshevskiy" from Murmansk to the Bering Straits in 1978 may be thought of as having begun about 20 years ago when the icebreaker "Lenin" completed the first high latitude cruise to debark the drifting station "Severnyy Polyus-10" and to place drifting automatic weather stations on the ice-pack edge. In 1970, the "Lenin" led the initial passage of freighters during the fall and winter seasons in the mouth of the Yenisey River to support the handling from the port of Dudinka of the output of the Noril'sk mining and metallurgical combine and the delivery of necessary materials and equipment. Between May and June 1971, the icebreakers "Lenin" and "Vladivostok" were the first to complete an early, high-latitude run from the western Arctic to the port of Pevek, circling the islands Severnaya Zemlya and Novosibirsk enroute, which confirmed the feasibility of high-latitude cruises by the modern icebreakers. Between February and April 1976, the "Lenin" led the first passage of a freighter to the Yamal Peninsula with cargo for the expanding oil and gas extraction industry in the far north. Thus, a firm foundation was laid for the commencement of year-round navigation to the port of Dudinka.

The steadfast work of the crew of the "Lenin" during 1977 and 1978 made possible the initial continuous operation of an icebreaker and its nuclear plant for 390 days, which was tantamount to realizing the potential for the uninterrupted year-round operations of nuclear icebreakers.

Between 1978 and 1979, the icebreaker "Sibir'" achieved the same results. Enormous scientific and management and engineering skills were applied to achieve these accomplishments.

The past 20-year period of exploitation of nuclear icebreakers and the practical operation of their nuclear reactors may be divided into two stages: the trials of the "Lenin" with its experimental, first generation shipboard nuclear steam-generating reactor, and the operations of the icebreakers "Lenin," "Arktika," and "Sibir'" using the small-series second generation test reactors.

The tests of the first generation shipboard reactors in the "Lenin" were carried out under difficult conditions because of the lack of experience in the practical operation of shipboard nuclear reactors generally and of nuclear vessels specifically. The trials and safe passages in the difficult to reach Arctic regions and high latitudes were begun during the fall and winter. The length of the navigation season was increased from 140 to 160 days and the planned cruising capacity of 210 days on one load of nuclear fuel was attained. The most important findings from the trials can be summarized as follows: the reactors operated reliably and

safely; they supported the passage of transient processes in the power system over all power ranges and the excellent maneuvering capacity of the icebreaker; and the systems and equipment of the nuclear plant provided for shifts in the operational modes of the reactors during safety actions and during the failure of isolated equipment systems. The shielding and other measures reliably protected the maintenance operators and the environment. The energy reserves in the core during the initial charge were sufficient for the icebreaker to operate in three Arctic navigation seasons; and the water and chemical regime of the reactors supported the demands placed on it by the materials.

Nevertheless, several shortcomings in the first nuclear reactors were identified: a shortage of basic equipment and an inadequate repair capacity for both individual types of equipment as well as for compartments in the center body section. The large number of sealing joints in the primary reactor circuit lowered its reliability and resulted in temporary shutdowns of the reactors and increased the generation of radioactive liquid wastes. The equipment and surfaces in compartments were not thoroughly prepared for decontamination operations; and the electric supply, control, and automatic systems required improvements.

The intensive operation of the first nuclear steam generating reactors resulted in the identification of the most significant problems in the engineering and technological maintenance of nuclear powered ships, the pinpointing of measures for solving these problems, the development of special equipment for the repair and recharging of the reactors, and the resolution of problems in the collection and recovery of radioactive wastes.

The experience gained from the operation of the first reactors led to a pressure reduction in the second generation reactors to 12.7 MPa; the simplification of the primary circuit by eliminating large fittings and reducing the number of circulating pumps in each reactor loop; an increase in the maintainability and the service life of the equipment, as well as the level of automation of the plant; and the development and installation of a new radiation control system.

By 1 January 1981, the number of operating hours of the second-generation nuclear steam generating reactor in the "Lenin" icebreaker was double that of the first generation, while the total generation of thermal energy increased 2.3 fold. Basic equipment comprising both generation reactors are presented in Table 3.

Table 3.

Equipment	First generation plant	Second generation plant
Reactors	3	2
Steam generators	1/6	1/8
Primary circuit pumps	3/18	1/8
Filters	2/6	1/2
Fuel channels in the core	219	241
Primary circuit gate valves	4/24	-

Note. The number preceding the virgule refers to the reactor primary circuit loop and the one following the virgule refers to the icebreaker installation.

Experience in operating the first generation reactors revealed the inadequate service life of basic components (including the steam generators, primary circuit gate valves, and the bellows fittings) and the high cost of disassembling and assembling of the radioactive components, which were the chief obstacles that interfered with the demonstration of the full benefits of nuclear energy.

The achievement of maximum service life of the components while maintaining the requirement for nuclear and radiation safety typified the general trend in the technical operation of the first and second generation steam-generating reactors. A service life of 9,000 to 10,000 hours was achieved for the basic components of the first generation reactors. Designs were developed, materials were selected, and water and chemical conditions selected that ensured at least the doubling of the service life. An enormous amount of work was put into developing and maintaining water conditions. The backlog of scientific and technical problems that were solved for the first generation reactor plants made it possible to achieve significant results for the second generation plants. The fail-safe operation of the steam generating reactors confirmed the true potential for increasing the service life to one that was comparable with other shipboard installations. This was reinforced in 1978 by a decision of the suppliers of the equipment. This marked the completion of a key stage in the establishment of nuclear power systems.

The increased lifetime and power output of the reactor cores have definite significance for the technical, operational, and economic indicators of the icebreakers. Steel and zirconium fuel element jackets for several core assemblies using uranium dioxide for fuel were operated in the first generation steam generating reactors. The design power output was attained for all of the assemblies. For the second generation plants in the "Lenin" and in the "Arktika" class icebreakers, several core assemblies were tested that had steel and zirconium fuel element jackets. The latter jackets had various shapes.

The energy supply of the cores in the second generation reactors was more than doubled. In 1980, the crew of the icebreaker "Sibir'" exceeded the calculated power output for one of the types of cores, thus verifying the potential for achieving

a cruising capacity of 450-500 days on one fuel charge. The time spent recharging the reactors, which is an important indicator of the operating period of icebreakers, is a nuclear and radiation hazardous operation both for the crew members and the environment. The average time spent for the recharging of the first generation reactors was about 95 days; for the second generation it is about 63 days. Some rechargings have been accomplished in 40 to 42 days. Assuming a relationship of 1:2 between the number of rechargers to the operating time (in years), the average annual time spent recharging is equivalent to 20 to 30 days. This figure already approximates the time expended during the bunkering of the diesel-electric icebreakers (Table 4).

Table 4.

Operations	Duration in Days "Krasin"	"Murmansk"	"Sorokin"
Reception of a full bunker	3.5	3.0	1.8
Washing (annually)	23.4	18.7	17.3
Total annual expenditure of time	35.6	26.2	29.0

The time spent on recharging the reactors has been reduced through the development of modern freight handling equipment, through further improvements in the construction of the reactors, and through the attainment of skills and higher qualifications by maintenance workers.

The generation of heat in the reactors is accompanied by powerful ionizing radiation and the formation of radioactive products from the fission in the fuel composition. The power of the ionizing radiation on the core surface of the first generation water-cooled reactor in the "Lenin" amounted to $2 \cdot 10^{13}$ neutrons/$cm^2 \cdot s$ and 3×10^{13} gamma quanta/$cm^2 \cdot s$. Comparison of these values with the permissible limits for living organisms indicates that shielding which reduces the neutron flux 10^{11} to 10^{12} fold and gamma quanta 10^{10} to 10^{11} fold must be installed around such a radiation source. The reactor is placed in a protective container or protective structures to safeguard maintenance workers.

The hazards from fission radioactive products are extremely high. Suffice to say that in a 100-Mw reactor $2.2 \cdot 10^5$ Ci of iodine-131 and 175 Ci of strontium-90 are generated in the nuclear fuel.

Barriers to prevent the release of fission fragments from the fuel composition into atmosphere include fuel element jackets, hermetic circuits for coolants, and reactor safeguards.

Besides the two radioactive factors mentioned, the formation in the coolant and the deposition on the surface of the primary circuit of radioactive products must be added, which result from the following processes: activization of corrosion products and corrosion of the construction materials in the core and the circuit; activization of impurities in the highly purified water; oxygen activization in the highly purified water; and the release of fission products through defects in fuel element jackets and the coolant.

An important conclusion relating to the new types of danger to the environment and maintenance personnel from reactor operations can be discerned from a brief summary of the factors accompanying the chain reaction of uranium-235 fission. The dangers encompass the hazards of "fresh" and "spent" nuclear fuel and nuclear fuel in use that arise from lack of control or management or improper storage, transfer, and transport of nuclear fuel; and the radiation hazard from ionizing radiation and fission products and activated products from the coolants and reactor primary circuit equipment.

Nuclear safety aboard the icebreakers is properly maintained through appropriate equipment and systems and their technical refinement and reliability, through the continuous control and monitoring of conditions, and through the level of professional training and discipline of personnel.

An awareness of potentially hazardous operations, during which conditions could arise that jeopardize nuclear safety and require the heightened alertness of personnel, has been introduced into the reactor maintenance system.

The nuclear power plants are equipped with radiation control systems to provide for the radiation protection of the environment and personnel. In 20 years, there hasn't been a single radiation incident on board the icebreakers that posed a serious threat to either the crew or the environment.

Experience with the repair and maintenance of the nuclear reactors has identified the need for a medical and shielding zone in the vicinity of the repair base and for the installation of medical facilities and a full-scale dosimetry system. During reactor operations, liquid and solid radioactive wastes are generated, which need to be collected, stored, recovered, containerized, and buried at long-term storage sites.

Collections of the wastes in the past confirmed the need for floating or shore-based storage tanks. The former tanks support the real-time solution of operational problems, the latter ones solve the problem of recovering the wastes and their long-term storage.

Problems associated with the unloading, acceptance, storage, packing, and shipment during the processing of spent fuel assemblies are fundamental ones for the base engineering and technological maintenance system. Special transshipment equipment (35 to 40 units) has been manufactured for the unloading of spent fuel assemblies and special storage facilities have been built. The equipment becomes radioactive after the frist recharging and must be decontaminated and repaired in a special shop in a restricted area at a coastal facility.

It must be noted that the lack of heat and power engineering for the berthing of nuclear vessels at bases (shore or floating) results in overconsumption of reactor thermal power. Such power losses for the icebreaker "Lenin" alone amounted to 5 percent of the total thermal power for the full period of operations of the first generation reactor plant and 6.6 percent for the second generation plant. Slightly less power losses are being observed for the "Arktika" class nuclear icebreakers.

Water purification for the primary circuits using ion exchange filters requires the construction of a special storage container for shipping tanks containing spent charge, although the service life of the resins lately has increased from 1,500 to 8,000 hours. Ion exchange resins produced for commercial use must be converted to an operational form that is compatible with the established water regimes. This technological task must be done at a special shore-based facility with a water and chemical laboratory.

Repair of equipment containing surface radioactive contamination must be done in a special shop in accordance with radiation safety requirements. The performance of potentially hazardous work in nuclear plant reactors is possible when the requirements for an absolutely safe berthing for the nuclear ship are met based on meteorological conditions (wind, sea state, tidal ebb and flow, and so forth).

Two independent electric supply sources of adequate power must be maintained for the reliable maintenance of reactor coolant circulation during the inspection and cooling of the steam-generating plant and during the secure disposal of residual heat release in the cooled down plant.

Nuclear power systems have rapidly established themselves in the Soviet maritime fleet. The forthcoming five-year plan, approved by the 26th CPSU Congress, stipulates: "Begin the fitting out of freighters with nuclear propulsion plants." As is known, construction of the "Rossiya," a new nuclear icebreaker, and nuclear lighter and container carriers is already underway.

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METHODS FOR ELIMINATING MANUAL LABOR

Moscow MORSKOY FLOT in Russian No 10, Oct 81 pp 14-17

[Article by B. Borisov, chief engineer, UEFiP [not further identified], Ministry of the Maritime Fleet, L. Larin, F. Romanovskiy, and A. Chernyak, State Planning Design and Scientific Research Institute for Maritime Transportation of the Ministry of the Maritime Fleet of the USSR: "Methods for Eliminating Manual Labor"]

[Text] The further expansion and strengthening of the material and technical resources within the marine ports continued throughout the Tenth Five-Year Plan. A series of highly productive, specialized systems were built for containers, mobile equipment, freight carried in trailers, and oversized bulk cargo to increase their carrying capacity, to refine the technology for freight handling, and to reduce the amount of manual labor during loading and unloading operations. Berths and warehouse facilities have been remodeled and new equipment has been installed and obsolete equipment within multipurpose transshipment complexes has been replaced to make the ports ready for the handling of the latest special purpose ships and the new types of freight. The ports have been replenished with domestic and imported multipurpose cranes and lifts, portable grain conveyors, and other equipment.

The strengthening of the material and technical resources within the ports combined with advances in technology and in the management of loading and unloading operations made it possible in 1980 to reduce the total labor expenditures in the ports by 14% compared to 1976, while the adjusted freight turnover and freight processing increased by about 15%. The efficiency of production lines increased 1.5-fold on the average, while the number of workers on each line decreased by three to four workers. This reduction allowed the conditional release of more than 2,300 port workers during the period. The rate of large-scale mechanization of cargo processing reached 93.7% in 1980, including rates of 84.5, 98.2, and 94.8% for general freight, bulk freight, and timber, respectively.

These indicators for the extent of large-scale mechanization are impressive. Nonetheless, the proportion of manual labor in the ports is still high. Moreover, the tempo of the reduction of manual labor has slowed.

Most of the items of freight transported in bags, small crates, boxes, drums, loosely compacted bales and parcels, wooden barrels, as well as some timber articles, particularly pulpwood, are packed into cargo spaces in stacks and hoists of

transport facilities. Stacks and hoists are also dissassembled by hand. The slinging of pieces of rough timber is labor intensive and hazardous. Because of the large size of the slings and the individual gripping devices, the slinging of equipment, heavy timber, and metal materials remains labor intensive.

The cleaning of cargo spaces, including ship's framing, particularly if cargo has caked, and occasionally the stowing of freight into holds are among the types of manual labor that are associated with the handling of bulk cargo. The opening and closing of the hatches of open wagons and the shielding of freight cars and railway clearances from freight residue are also done by hand.

About 35% of the labor of dock workers is now devoted to operating hoisting and transporting machinery, 40% on performing auxiliary tasks (slinging, guiding the hoist to the stowage site, fastening, etc.), and 25% on doing the difficult and cumbersome operations involved in the manual transfer of cargo, which includes using simple devices.

The expenditure of manual labor is particularly high during the handling of crates, unpacked freight, bags, boxes, bales, and parcels. Within the total volume of labor output for handling this cargo, the proportion of manual labor is equivalent to 60 to 75%. The volume of freight processing for these items amounts to just 14%, but they require 54% of all of the manual labor of the dock workers. For the remaining freight, which amounts to 86% of the processing volume, only 46% of the total of manual labor is used.

What are the methods for liquidating, or at the very least reducing, the expenditures of manual labor during the loading and unloading operations in the ports?

The methods should primarily involve creating new or increasing the loading of existing special purpose systems for container carriers, ro/ro vessels, bulk carriers, and ferries. There is no doubt that progress in maritime transport has been associated with the further improvement of shipping of package, general, and timber cargo using enlarged berths. Shipments of bulk cargo will increase through the use of special purpose ships that are fitted out for high productivity freight handling. The introduction of special purpose complexes ensures the solution of two primary problems in the development of the ports -- the marked increase in the intensity of use of transport facilities and the large-scale mechanization and automation of cargo operations.

The building of such complexes over the past 10 years is the most notable feature in the development of the material and technical resources in our maritime ports. As a result, the current carrying capacity of the special purpose complexes comprises about 30% of the installed capacity of all of the dry cargo complexes in the ports. This intensity will be developed further during the 11th Five-Year Plan. The capacity of the special purpose complexes will reach 40% of all of the carrying capacity in the ports.

It is appropriate to mention at this point that the special purpose complexes are being underemployed under certain circumstances. Thus the capacity of the

complexes to handle containers and ro/ro carriers is used at a rate of 75% and at 77% for bulk freight. In many instances, especially for bulk freight, this is explained by the lack of appropriate cargo for a given destination.

Moreover, there is no reason to accept the situation that large tonnage containers and mobile equipment are being processed in ports with poorly equipped berths when special-purpose facilities are available. Of course, the technical and economic indicators for such operations are somewhat inferior, since vessels must remain in ports longer, but the state pays for the additional expense.

The inadequate development of the "door to door" shipment of containers is another reason for the inferior effectiveness of container complexes. Currently, more than 60% of the containers in ports are packed and unpacked using enormous amounts of manual labor.

The development and introduction of technological processes for using machinery and devices for the mechanization of holds, railroad freight cars, warehousing, and other operations during the handling of crates, bags, boxes, bales, and parcels is a second trend in the attempt to reduce manual labor.

Notwithstanding the rapid development of containerization and palletization of shipments and the introduction of such advanced transportation and technological systems as ro/ro vessels, ferries, and lighter carriers, the volume of shipments of pieces of freight using conventional methods (for example, single item packing in the cargo spaces of transportation facilities) will still be rather high for sometime to come.

The proportion of general cargo will amount to about 50% of the total volume of shipments for the next 15 to 20 years according to best estimates. Consequently, the mechanization of the handling of such cargo will continue to be vital indefinitely.

It is relevant that during the mid 50's and early 60's the design and testing of special machinery and devices for cargo holds, freight cars, and to a lesser extent warehouses were carried on extensively within the shipping industry. About 30 prototype machines and devices for custom-packed and bulk freight were produced and tested. Some of the machinery was placed into series production (including the PTSh-1.5 loader and the PTS, MVS, and PTB engines).

This approach to work was gradually eliminated with the appearances of the new type ships, containerization, palletization, and so on. All of these changes evidently conflicted with conventional shipping techniques and would, if not immediately then gradually, eliminate the more conventional techniques from maritime shipping practices. However, the modernization of shipping techniques is not happening quite as rapidly as it was expected to 15 to 20 years ago.

We believe, therefore, that it would be worthwhile to revive the search for ways to mechanize hold and other cargo operations that are currently done piece by piece in the ports. A good starting point probably would be to revive that development system that once was prevalent within the Ministry of the Maritime Fleet and which

yielded excellent results. The system we refer to is that of: "Research -- design -- manufacture -- and implementation" during the development of machinery and devices for use in port operations.

During the time that the system was prevalent, the basic research center for studies on enhancing the technology and mechanization of freight operations within the ports was established within the State Planning Design and Scientific Research Institute for Maritime Transportation of the Ministry of the Maritime Fleet of the USSR; which, however, does not contain the design facilities for the development of the necessary devices and gear.

The Black Sea and Baltic central planning and design bureaus, which earlier jointly completed research both on the mechanization of cargo operations as well as the design and development work on the findings of this research, are now concerned with these tasks to a significantly lesser extent than they were in the 50's and 60's.

Between 1976 and 1980 these central planning and design bureaus and the bureau of the test plant of the administration for the production and installation of equipment developed gripping devices and gear at at a rate that was one-half the demand for them.

Evident from this is the necessity for the rigid centralization of the design and development work and consideration of the findings of the studies of the State Planning Design and Scientific Research Institute on the technology and mechanization of cargo operations. The establishment is recommended of a special design bureau which is functionally subordinate to the UEFIP within the Black Sea Central Planning and Design Bureau.

Preliminary calculations indicate that 150 types of machines and gear are required for the mechanization of hold, warehouse, and other port operations. The one-time demand for these machines and gear amounts to 4,500 units, including 500 to 600 machines. Industry does not manufacture any of this equipment, and experience has shown that they will not startup the manufacture of them because of their limited output. Therefore, production of this equipment must be organized within shipping enterprises.

But much of the requirements for attachments for cranes and loaders for cleaning and other machinery for hold and freight car operations cannot be met using existing manufacturing facilities within the sector, even if shipyards are called on to assist.

One solution to this complicated problem would be to establish special-purpose production facilities within the basins, which would provide for the centralized manufacture of the necessary gripping devices and machinery, along with spare parts for the newest lifting and transporting gear that is being imported for use in the maritime ports. The economic benefits of the establishment of such production facilities are fully compatible with the benefits of building the new technology transshipping complexes in the ports.

It has been calculated that the labor expenditures for handling custom-packed freight will be reduced by 22% within the current five-year plan alone; 14% of which will result from reductions in the handling of single pieces of freight and 8% from the mechanization of manual labor. The growth of this trend during the 11th Five-Year Plan could, in effect, completely eliminate the manual labor during the transfer of the most labor-intensive freight.

Regarding all other freight, the introduction of new gripping gear and attachments to cargo lifting machinery will make it possible to reduce the labor expenditures for transshipping metals by 20% and that for timber freight by 5%. Additionally, labor expenditures during the transshipment of bulk freight could be reduced by 13% through the development of new or the upgrading of existing highly productive special-purpose complexes, the use of new machinery and gear for cleaning operations, the cutting back on the amount of loose freight, and increases in the carrying capacity of multi-purpose cranes.

The refinement of technology, the reduction of labor input, and the elimination of manual labor during cargo handling are particularly important as far as the extreme north is concerned, because of the extremely harsh conditions there and the shortage of personnel. The general trend in the reduction of the labor input for cargo handling here, including transshipments on to unequipped shore points, is toward the broad application of palletization. Long-range planning calls for containers and other enlarged freight units, including air cushion ships.

If the specified measures are implemented within the next few years, labor expenditures for the sector in general for the shipment of one ton of freight could be reduced by 14% by 1985 in comparison with 1980, including a 23% reduction for freight handling and 26% for auxiliary operations. In this event, the rate of large-scale mechanization of loading and unloading operations will reach 95.2% by 1985. Conditions will be created to release 2,600 dock workers, who will be retained for work on 70 mechanized lines.

The growth in transshipments of freight via the special-purpose, highly productive complexes and the upgrading of the technology of freight operations within multi-purpose complexes using large-scale mechanization of cargo operations will ensure a 20% increase over that in 1980 in the speed for processing a ship by the time of completion of the 11th Five-Year Plan.

The development and efficient operation of the highly productive special-purpose complexes presents some obvious difficulties. For the ports, the difficulties are clearly related to a shortage of domestically manufactured equipment and the higher requirements for the professional qualifications of the dock workers, the efficiency of production, and the management of cargo processing.

By and large, these difficulties also are related to the organizational and legal status of the interrelationships between the participants in the transshipments. To increase efficiency, the full application of the technical potential of the new systems, particularly containers, must be used more. The full application of the technical potential of the new systems requires the creation or refining of the statutes and rules, the regulatory laws, and the duties and responsibilities of all of the participants in the shipping of freight using containers over direct

and indirect routes, and the development of combined programs for the expansion and improvement of the functions of the basic transport centers and the facilities for dispatchers and consignees. It is vital to note that those problems that are pertinent to reactivated systems must be solved before the creation of their material and technical facilities, and not after they have been placed into operation.

The thoughts that we have summarized in this article on methods for solving what is perhaps one of the most crucial and difficult problems in the ports -- the elimination of manual labor to intensify technological processes -- are only general ones, and, consequently, do not encompass all of the aspects of the problem. The documents which would define the requirements, size, and schedules for introducing the measures for the gradual elimination of manual labor in the ports could describe complex, special-purpose programs. Such programs evidently must be developed in the next two or three years, particularly for custom-packed freight.

Only through the large-scale implementation of these basic measures for the elimination of manual labor during cargo handling will the number of dock workers be reduced and the attractiveness of their work be enhanced. Such measures, along with further improvements in the management of port operations, represent a way to truly reduce the idle time of ships in the face of a critical shortage of workers.

The Soviet Ship Registry Reports

Data on the USSR Maritime Fleet as entered in the Soviet Ship Registry to 1 July 1981 (self-propelled merchant vessels with a gross tonnage of at least 100 register tons)

	Steamships		Motorships		Total	
Type Ship	Units	Register Tons	Units	Register Tons	Units	Register Tons
Passenger and cargo/passenger	8	120,028	250	603,051	258	723,079
Dry cargo	92	561,797	2230	9,875,824	2322	10,333,965
Tanker ships	40	1,460,316	440	3,793,571	480	5,253,887
Service and auxiliary ships	88	77,494	759	441,643	847	519,137
Fishing vessels	47	153,270	2715	4,547,396	2762	4,700,666
Research ships	18	18,432	406	365,960	424	384,392
Others	5	47,076	385	524,564	390	571,640
Totals	298	2,438,413	7185	20,152,009	7483	22,590,422

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UTILIZING EXHAUST HEAT

Moscow MORSKOY FLOT in Russian No 10, Oct 81 p 47

[Article by P. Nechitaylenko, chief of ship management, Novorossiysk Steamship Company, and A Derepovskiy, senior engineer, sector for heat engineering during ship trials: "Utilizing Exhaust Heat"]

[Text] Fuel and energy economy assume greater and greater significance as each year passes. The rational use of the heat from the exhaust of internal combustion engines could provide significant fuel savings.

A large series of "Lisichansk" type vessels with 9RD90 engines operates within the Novorossiysk Steamship Company. In these engine systems, 40.9% of the thermal energy is used by the main engines, 12.2% is converted into steam in the exhaust heat boiler, and only 1.0% of the total thermal energy from the fuel is applied as useful power from the turbine generator (280 kw).

The exhaust heat boiler was designed to generate saturated steam at 5000 kg/hour at a pressure of 1.0 MPa when the exhaust is 118,000 kg/hour at temperatures of 280 C at the inlet and 180 C at the outlet. To lower the exhaust temperature in the exhaust heat boiler, an economizer was installed in which feed water is heated from 90 to 160 C. The heating surface comprises seamless, ribbed steel tubing. Appropriate design and assembly of the heating elements made it possible to support a level of gas resistance in the boiler (100 mm Wg) that, in effect, does not interfere with the operation of the main engines. Because of changes in the operating parameters of the main engines, the steam generating capacity of the exhaust heat boiler is 16 percent higher than the rated capacity.

The 280kw Mitsubishi turbine generator, containing an obsolete impulse turbine with inferior cost benefits, is unreliable and has now just about used up its engine service life.

The Novorossiysk Steamship Company in cooperation with the Black Sea Steamship Company Central Planning and Design Bureau have developed

(and fitted in three vessels) the domestic TGU-500 turbine generator to replace the Mitsubishi model. The TGU-500 generator comprises a self-excited impulse turbine with auxiliary machinery mounted on the same foundation frame and a built-in condenser. The TGU-500 is supplied with nozzle steam distribution for cost effective operation and reduction of steam throttling. In terms of basic heat engineering indicators, the TCU-500 turbine generator is competitive with foreign models.

The cruising load of the electric power plant in the "Lisichansk" type freighters is 460 kw or less. Tests have shown that the steam generators completely supply the cruising load of the plants from the heat exhaust boiler, while distributing steam to all of the shipboard users. The characteristics of the turbine generators and the heat exhaust boilers are presented in Figures 1 and 2.

Since the heat exhaust boiler generates saturated steam and the turbine generator is designed to operate on superheated steam, two methods of generating superheated steam are used to ensure the long-term performance of the turbine generators: throttling of steam from 1.6 down to 0.7 MPa (superheating occurs at 10 C) and installing an additional section in the heat exhaust boiler, which acts as a superheater.

The payback in fuel alone for this modernization is achieved in 1.7 years, and subsequent savings amount to 45,000 rubles. Additionally, the labor expenditures in servicing the turbine generators are 20 times lower than those for diesel generators, which is of vital interest to those freighters that have understaffed crews.

Currently, plans are being drawn up within the Novorossiysk Steamship Company for the replacement of the "Nadrovski" (Federal Republic of Germany) turbine generators in the "Marshal Budennyy" class freighters, as well as for the replacement of one of the diesel generators in the "Marshal Grechko" class freighters with a turbine generator.

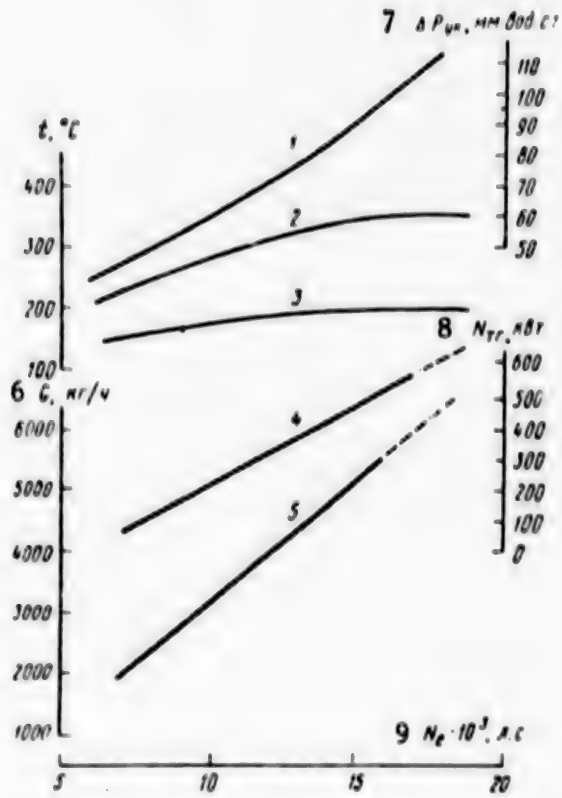

Figure 1. Changes in the Performance of Exhaust Heat Boilers and Turbine Generators as a Factor of Engine Power

Key:
1. Resistance of the exhaust heat boiler
2. Gas temperature up to the exhaust heat boiler
3. Gas temperature beyond the exhaust heat boiler
4. Turbine generator load
5. Steam generating capacity of the heat exhaust boiler
6. G, kg/hour
7. $\Delta P_{\text{exhaust heat boiler}}$,
8. $N_{\text{exhaust heat boiler}}$, kw
9. $N_e \cdot 10^3$, hp

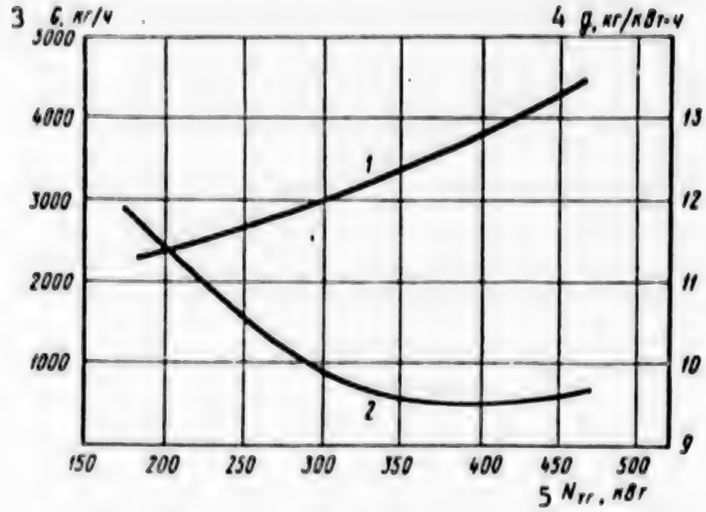

Figure 2. Saturated Steam Consumption by the TGU-500 Turbine Generator as a Factor of Load

Key:
1. Hourly steam consumption
2. Specific steam consumption
3. G, kg/hour
4. g, kg/kw-hour
5. $N_{\text{turbine generator}}$, kw

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SOVIET FOREIGN TRADE AND MARITIME SHIPPING

Moscow MORSKOY FLOT in Russian No 12, Dec 81 pp 2-3

[Text] The USSR Central Statistical Administration has published the abridged compilation of statistical tables "SSSR v tsifrakh v 1980 godu" [The USSR in Figures in 1980], in which information is given on our state's economic and social development in 1980, along with comparisons with 1940, 1970, 1975 and other years. It also includes certain information on the economic and cultural development of a number of socialist countries. A number of indicators are compared with the figures for the capitalist states.

We need to say that in 1913 Russia's share was only slightly more than 4 percent of world industrial output. At the present time more than 40 percent of the total volume of the world's industrial output is produced by the socialist countries. The CEMA member countries account for approximately one-third, and the Soviet Union one-fifth. Our country is now producing a larger industrial output than the entire world in 1950.

The Soviet Union possesses a national wealth exceeding 2,700 billion rubles (not including the value of land and forests). And this was achieved even though the huge losses the country suffered in World War II amounted to about 30 percent of the national wealth. Its most important part--fixed capital--amounted to 1,744 billion rubles at the end of 1980, including 1,149 billion rubles of fixed productive capital (in 1973 comparable prices).

In the last 5-year period the growth rates of fixed capital reached 39 percent, and in transportation and communications they reached 40 percent. In 1940 the 1980 daily output would have taken 27 days for electric power, 19 days for petroleum (including gas condensate), 135 days for gas, 15 days for motor vehicles, 18 days for tractors, 8 days for steel, 32 days for manufactured fertilizers, and 22 days for cement.

Whereas maritime transport carried 90,000 tons of cargo and 26,000 passengers per day in 1940, in 1980 those figures were 623,000 tons and 141,000 passengers.

The freight traffic of all branches of transportation increased from 494.4 billion ton-kilometers in 1940 to 6,165.2 in 1980, i.e., more than 12-fold. It nearly doubled in just the last 10 years.

The freight traffic of the Soviet Merchant Marine is bound up to a considerable extent with the development of the country's foreign trade. Between 1950 and 1980 the total volume of the USSR's foreign trade in prices of the respective years (foreign currencies converted to rubles at the rate of exchange set by USSR Gosbank on the basis of the ruble's gold content, which is 0.987412 gram of pure gold) increased from 2.9 to 94.1 billion rubles. In the 1976-1980 period alone the volume of the Soviet Union's foreign trade with the socialist countries increased from 31.6 to 50.6 billion rubles (including an increase from 28.8 to 45.8 billion rubles with the CEMA member countries), with the advanced capitalist states it increased from 18.7 to 31.5 billion rubles, and with the developing countries from 6.5 to 12.0 billion rubles.

At the present time the USSR is carrying on trade with 139 countries of the world, whereas in 1950 they numbered 41. In 1980 53.7 percent of Soviet foreign trade was with the socialist countries.

According to figures in the collection of statistical tables "Vneshnyaya torgovlya SSSR v 1980 g." [Soviet Foreign Trade in 1980] the GDR, with 9.8 percent of the total volume of trade, is first among the socialist countries with respect to its relative share of Soviet trade, and then comes Poland with 8.5 percent, Czechoslovakia with 7.6 percent, Bulgaria with 7.5 percent, and Cuba with 4.5 percent.

Foreign trade with the advanced capitalist countries represents 33.6 percent of the total volume of Soviet foreign trade. Among these countries first place is taken by West Germany--6.1 percent, which is followed by Finland with 4.1 percent, France with 4.0 percent, Italy with 3.2 percent, and Japan with 2.9 percent.

The USSR's trade with the developing countries in 1980 amounted to 11,961.7 million rubles, or 12.7 percent of the USSR's total trade. The USSR's largest trading partners are India, Argentina, Iran, Afghanistan and Libya.

Our country has been developing extensive economic and scientific-technical cooperation advantageous to both parties with countries that have won their independence.

Our trade and economic relations have become increasingly stable with the countries of Africa, especially with Angola, Algeria, Ethiopia, Mozambique, Nigeria and Morocco. Such relations are now maintained with 47 independent countries, and the volume of foreign trade with them has increased more than 40 percent over 1975 and reached a level of 2.0 billion rubles.

In 1980 the USSR exported goods worth 49.6 billion rubles, i.e., 17 percent more than in 1979. There was at the same time an increase in the exports of power engineering and metallurgical equipment and motor vehicles. Fuel, electric power, industrial raw materials and supplies have an important place.

The USSR's imports were valued at 44.5 billion rubles, the share of machines, equipment and transportation equipment was 15.1 billion rubles.

It is well known that it is not enough merely to sell or to buy goods; it is an equally important task to deliver those goods as ordered. In our country maritime shipping has the leading place in this effort, carrying approximately one-half of our foreign trade, i.e., just as much as all the other branches of transportation taken together.

This is vividly evidenced by the figures given in the table (for 1980).

Branch of Transportation	Soviet Exports: Thousands of Tons	Soviet Exports: Share, %	Soviet Imports: Thousands of Tons	Soviet Imports: Share, %	Total: Thousands of Tons	Total: Share, %
Rail	89,925	25.8	18,980	24.1	108,905	25.4
Maritime	149,803	42.9	55,648	70.6	205,451	48.0
River	10,269	2.9	1,758	2.6	12,027	2.8
Highway	468	0.1	363	0.5	841	0.2
Pipeline	98,981	28.3	2,064	2.2	101,045	23.6
Air	5	--	19	--	24	--
Total	349,461	100.0	78,832	100.0	428,293	100.0

So that foreign trade can be served without interruption maritime vessels with varying load capacity and technical characteristics are being built in our country and acquired abroad, seaports are being built and undergoing reconstruction, they are being furnished advanced equipment and entire large-scale cargo-handling complexes, the capacities of ship repair yards are being augmented, and other components of the shore support facilities of maritime shipping are being strengthened.

At the present time a majority of the vessels in the USSR's maritime fleet are employed carrying cargo in international traffic. This traffic accounts for 92 percent of the maritime fleet's entire cargo traffic in ton-miles. The vessels of the fleet make tens of thousands of calls every year, visiting about 1,300 ports in more than 125 countries in the world.

A fair share of the export and import cargo is time-consuming: machines, equipment, transportation equipment, chemicals and timber and lumber, as well as foodstuffs and industrially produced consumer goods. This means that important problems have to be solved concerning their shipment and transshipment in ports. The ministry's ports are operating under a heavy strain in handling the growing foreign trade, serving as they do not only Soviet vessels, but also a sizable number of foreign vessels.

The geography of our country's foreign trade relations with other countries is expanding every year; moreover, this is largely with countries with which foreign trade is carried on entirely or predominantly through the efforts of the maritime fleet.

At the 26th CPSU Congress Comrade L. I. Brezhnev noted that long-range target programs for further intensification of socialist integration are now being embodied in specific deeds. Coordination of the national economic plans of the

CEMA member countries for the 1981-1985 period is drawing to a close. "In speaking of the achievements of our joint effort," L. I. Brezhnev said, "we take legitimate pride in mentioning such large-scale projects as the Soyuz Gas Pipeline, which is nearly 3,000 km long, the Mir Electric Power System, to which new power transmission lines have been added, the Ust'-Ilimsk Pulp Mill, the Erdenet Mining and Ore Dressing Combine in Mongolia, nickel plants in Cuba and many other new construction projects. But in future there are still larger undertakings for the benefit of our entire commonwealth."

Workers in maritime transportation are doing everything in their power to make a worthy contribution to the common cause of the international division of labor and to further integration of the fraternal CEMA member countries. A large volume of cargo is also carried between the USSR and the ports of the other socialist countries by the Danube River.

In discharging their international duty the crews of vessels of the Far East, Primorskoye, Black Sea and a number of other shipping companies are seeing that export goods are delivered without interruption to Vietnam and Kampuchea. The shipping of goods involved in the USSR's trade with the Republic of Cuba occupies one of the leading places in the operation of the Baltic, Black Sea and Novorossiysk Shipping Companies. The international socialist competition that has been developing between Soviet ship crews and Cuban dockworkers is having a large impact toward the faster processing of vessels.

The Soviet Union's foreign trade relations are becoming stronger with the countries of Latin America. Referring to relations with this group of countries, Comrade L. I. Brezhnev said at the 26th party congress, "We note with satisfaction expansion of mutually beneficial relations between the USSR and the Latin American countries, and we are ready to develop those relations even further." On the basis of contracts already concluded pipeline equipment worth more than 2.5 million rubles is being delivered to Argentina in 1981 and 1982.

Machines, equipment and transportation equipment are being exported in sizable amounts by the USSR (7.8 billion rubles in 1980); these goods are being carried to 72 countries of the world. Judging by the geographic pattern of exports on this list of complicated and labor-intensive goods, most Soviet shipping companies of the Baltic, the Black Sea and Sea of Azov, and the Far East are involved in carrying them.

Petroleum and petroleum products are being exported to 32 countries (18.1 billion rubles in 1980). A sizable portion of this cargo is being delivered to many countries by the Druzhba Pipeline. France, Italy, West Germany, Finland, Great Britain, and the Netherlands among the industrially advanced capitalist countries, and India among the developing countries are the leaders in purchases of Soviet petroleum products. These cargoes are carried by the tanker fleet of the Latvian, Novorossiysk, Georgian and Primorskoye Shipping Companies.

Soviet vessels are taking a large part in exports of rolled products of ferrous metals, or (38 million tons in 1980), and potassium salts (6.6 million tons). Logs (13.9 million stacked cubic meters in 1980) were exported last year mainly to Japan and Finland. Conifer lumber (6.9 million stacked cubic meters) were

shipped in 1980 to 25 countries of the world, Great Britain, Italy, Belgium, the Netherlands, West Germany and France occupying the leading place among the capitalist countries. The Northern, Murmansk, Baltic, Far East and a number of other shipping companies have an adequate specialized fleet of timber carriers to handle the wood cargo. The export of sawn lumber from Igarka to European and African ports and of timber to Japan, involving transshipment in our Far Eastern ports, has a distinguished place in this traffic.

Machines, equipment, transportation equipment, foodstuffs, including grain, industrially produced consumer goods, etc., occupy a large place among Soviet imports. In 1980 ships and ship equipment delivered to the USSR from 15 countries of the world total 1,240.1 million rubles.

Compensation deals, in which payment is made for equipment delivered for various enterprises by subsequent delivery of products from the facilities after construction, are beginning to take a larger and larger place in the country's foreign trade. For example, suppliers are receiving a corresponding amount of gas, petroleum or petroleum products for equipment and pipe delivered for enterprises of the gas or petroleum industry. According to the figures of the Ministry of Foreign Trade, the possibility is now being discussed of concluding new compensation agreements, specifically concerning construction of a main gas pipeline between Western Siberia and the western border of the USSR, to export natural gas to the countries of western Europe.

Soviet foreign trade organizations have already concluded major long-term contracts with various firms in West Germany, Finland, France nd Italy for mutual deliveries of various products over the years of the 11th Five-Year Plan. Our country will be importing machines and equipment, including complete sets of equipment for many projects near completion in ferrous and nonferrous metallurgy and the chemical, pulp and paper, timber and lumber, coal, gas and other industries, ships and marine equipment, etc.

Maritime shipping companies are taking into account the traffic of these cargoes in their long-term and operational plans as well as in plans for development of port facilities, for further expansion of interlinkage with related branches of transportation and with foreign trade subdivisions.

Port personnel are also making an important effort to speed up the processing of vessels and freight cars and to ship out cargo to consumers on time. Seaports are being furnished high-capacity new cargo-handling machines, the number of port personnel is being increased, and the system of material and moral incentives is being strengthened.

The experience of the Leningrad transport workers in interlinkage with related branches of transportation on the basis of unified schedule-plans within transportation junctions, which has been approved by the CPSU Central Committee, is the basis for the activity of port personnel.

The workers in maritime transportation, who have entered the nationwide socialist competition for successful fulfillment of the decisions of the 26th CPSU Congress, are doing everything in their power through their self-sacrificing labor

to cope honorably with the tasks of handling the country's foreign trade that travels by sea in the 11th Five-Year Plan. They fully support the consistent course of the Soviet Union toward broad development of international economic co-operation in the interests of preserving peace, of deepening detente and mutual understanding among nations, and of raising further the prosperity of the Soviet people.

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VESSEL CARRIES FOUR 200-TON CRANE TOWERS WITHOUT DISASSEMBLY

Moscow MORSKOY FLOT in Russian No 12, Dec 81 pp 22-23, 40

[Article by Yu. Shashkin, captain-instructor of the Baltic Shipping Company, and D. Efishev, captain of the motor vessel "Stakhanovets Yermolenko": "A Singular Haul"]

[Text] A day before the 26th CPSU Congress began its proceedings, the motor vessel "Stakhanovets Yermolenko" completed the transport of eight towers of grain transporter cranes from Ravenna (Italy) to ports on the Black and Baltic Seas.

Only a specialized vessel with sufficient reserve of stability, maximum opening of the hold and high freeboard could carry in one haul four towers of grain transporter cranes with a height of 40 meters and a weight of about 200 tons each.

A grain transporter crane is a structure consisting of two towers mounted on a pontoon. The power plant is accommodated in the pontoon, and the pumps, filters, scales and other equipment in the towers. Pipes for transporting the grain in loading or unloading are attached on the outside of the towers. The pontoons of the grain transporter cranes were towed by sea to the ports of Odessa, Il'ichevsk, Riga and Leningrad, and their towers had to be carried on board the "Stakhanovets Yermolenko."

We knew of the method of carrying towers which had previously been disassembled. Each of them was divided into three sections with partial disassembly of the internal equipment and service lines, which were then loaded in the hold of the motor vessel. In this case the ship could carry only two towers per trip. At least four trips had to be made to carry eight towers. In addition, disassembly in Italy and the subsequent assembly of the towers in the Soviet ports would considerably increase the cost of delivering the equipment and would extend the date by which it would be put into operation.

The decision was made to develop an alternative for hauling four towers of the grain transporter cranes at one time without disassembly. Calculations of static and dynamic stability made on the ship's computer showed that if the loads were distributed on the pontoon deck up to the permissible limits, safe transport of four assembled towers would be guaranteed, and the ship's passage would be without danger in the autumn and winter conditions of the North Atlantic if a spell

of good weather was chosen. The curve of dynamic stability taking into account the vessel's sail area and the load met the stability standards of the USSR Register: at M_{opr} [tilting moment] = 3,412.4 ton-meters, M_{kr} [heeling moment] was 2,213.2 ton-meters. Thus the principal weather criterion had the following values: K = 1.54 at the start of the voyage and K = 1.31 at the end of the voyage.

The most crucial and time-consuming part of the calculations proved to be designing the underpinning to spread the cargo loads on the pontoon deck during the movement and after placement in the hold of the four 200-ton towers and the subsequent securing of this equipment to the coaming of the hold by steel cables.

The towers were assembled in the plant yard at a distance of 25-70 meters from the mooring. There was no floating crane of suitable load capacity in Ravenna, and the owners of the cargo proposed that they be loaded on rails.

The motor vessel was moored stern-on, and a ramp was run to it. Parallel concrete beds, each about 1 meter wide, were made for each of the two front supports of the towers, and were placed against the swivel tongue of the ship's ramp. Then two longitudinal I-beams with a section of 600 x 600 mm and a length of 60 meters each were laid in the hold of the ship on the pontoon deck.

Two special frames joining the "way" on the shore to the I-beam underpinning on board the ship had to be assembled to link the dock and the pontoon deck on the ramp. For safety's sake in moving the towers from the dock to the ramp the vessel had to be stabilized so that the railway could be properly joined between the shore and the ramp. Vertical and horizontal displacements of the stern section had to be kept under 5 cm. Vertical stabilization was achieved by constantly ballasting the vessel using two large pumps (with a capacity of 1,000 tons each), and horizontal stability with eight mooring lines.

Box rails, which served as guides for sliding the towers along, were placed along the top of the concrete beds on the platform and in the hold. The towers of the grain transporter cranes were set upright in the assembly yard with four jacks. Then skids were attached to each of the four supports. The entire transporter structure was set up on the rails, on which greased lignum vitae sheets had been placed. The towers could thus slide freely along the rails, pushed by two hydraulic jacks. The I-beam structures mounted on the pontoon deck also served as guides for laying the rails. Once the movement of the towers was completed, these structures became their underpinning during transport. In the hold the skids were disassembled, the rails were taken up, and the four supports of the tower base were welded to the frame of the underpinning. All eight towers, which were transported in two trips, were loaded by sliding them on one after the other. The rate of movement of each tower by means of the jacks was 5-10 meters per hour. All the operations of reinforcing the deck and also preparing the underpinning in the hold and on the dock took 22 days. The loading took 28 days. The preparatory work was lengthy because of the singularity of the very method of simultaneous transport of four 200-ton grain transporter crane towers. During transport the towers stood on four supports, each of which had a section at the butt end of an I-beam 250 x 250 mm. The pressure on the deck of each support was 50 tons.

Much attention was paid to the problems of securing the towers, since their centers of gravity were 3.72 meters above the coaming of the hold, and the capsizing angle of each of the towers was only 16°.

Securing by means of welding could not be considered reliable; weld seams do not hold when the sea is disturbed during navigation and the hull is deformed. That is why the tried and true method of securing with steel cables was used.

The large sail area of the cargo, amounting to about 1,800 square meters, was taken into account in calculating the ship's stability.

We had to solve the entire interrelated set of problems in a very short time before loading and to submit the cargo plan and principal numerical data to the firm doing the loading. The crew received a great deal of help in this effort from the Leningrad Central Project Planning and Design Bureau, with which we were in constant contact. On the second trip the last four towers were loaded for ports of the Baltic Sea in just 12 days, since the loading procedure and securing system had already been worked out.

In the period when the plant was engaged in preparing for loading and in assembly of the track, the crew made computations for securing the cargo with steel cables. Formula 6.4.2 in the "Rules of Maritime Vessel Classification and Building" (Volume I, Part III, Chapter 6.4 "Masts of Special Construction") was used as the basis in the computations. The system of securing the towers with cables was calculated without allowing for welding the tips of the tower supports to the vessel's deck. Since the tower's center of gravity was above the coaming of the hold, the securing system meant that a large number of steel cable lines had to run from the securing points on the vessel (rings and eyes) to a considerably smaller number of securing points on the towers (eight points on each structure). The working load on the ship's rings, which is 7 tons, had to be taken into account, a cable chosen of the proper diameter, and the securing lines optimally distributed. The securing work was done by the crew. It used 5,800 meters of 20-mm steel cable weighing a total of 9 tons, 2,276 adjustable clamps, and about 400 rigging screws. The securing cables were run to a height of 17 meters above the deck of the hold.

The long length of the securing lines (up to 22 meters) made it necessary to use mechanical aids. Double-sheaved block and tackle, secured with rope, was used to tighten most of the securing lines, along with the derrick winches and ship's capstans installed on the upper deck. In a number of cases TIFORO devices were used to ensure the proper tension. To give a picture of how much work the crew did it is sufficient to say that 114 lines were run to secure just one tower at the stern end.

The method of securing the towers was approved by representatives of the consignor. For our part we invited a surveyor from the Italian transport ministry, who checked the vessel's stability, its longitudinal strength, and also the method and system of securing the equipment, and he issued a safety certificate for carrying the cargo under the conditions of the winter Atlantic.

The trip from Italy to the Baltic took place with guidance of the Leningrad Weather Center, and synopsis maps were analyzed on the ship. The trip was made successfully.

Thus the crew of the "Stakhanovets Yermolenko," taking maximum advantage of the motor vessel's design and technical peculiarities, reduced to less than half the time required for delivery of valuable equipment. The last set of towers was delivered to Leningrad on 22 February 1981.

Up to now there has been no similar transport of one-of-a-kind large-dimension equipment in world maritime practice.

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BOOK ON LINE SHIPPING REVIEWED

Moscow MORSKOY FLOT in Russian No 12, Dec 81 p 11

[Review by A. Pushkar of book "Organizatsiya raboty lineynogo flota" [Organization of the Operation of the Liner Fleet] by P. Ya. Panarin, Izdatel'stvo "Transport", Moscow, 1980]

[Text] The sizable share of tonnage employed in line shipping and the constantly growing volume of export and import cargo account for the growing influence which maintaining lines is having on maritime shipping.

A book by P. Ya. Panarin, published in 1980 by the Transport Publishing House, is devoted to the subject matter of line shipping.

This monograph discusses the problems of line shipping on the basis of scientific criteria and models, which is an appreciable contribution to development of the methods of the organization and management of the liner fleet's operation. The book also demonstrates the relationship between efficiency and quality of line service: cargo delivery time, regularity of shipments, and the deadlines to which the operation of lines is subject. It is noted in this context that the present indicator of imputed costs and the method of comparing variants do not take into account all aspects of transport service. The author proposes a new method of substantiating types of vessels for line shipping.

A separate chapter in the book is devoted to drawing up sailing schedules based on optimum deployment of the fleet. The method of determining the reserve time to be allowed on lines for contingencies deserves attention.

The author has an interesting approach to the problems of managing line shipping, one in which he formulates for every level of management his own optimality criteria and models and examines in detail the problems of operational management and methods of regulating line shipping.

Many topics taken up in the book have not been given much previous treatment in the domestic literature. For instance, it offers a complete classification of cargo lines and states precisely the characteristics on which it is based.

While we regard the author's proposals as fundamentally correct, a number of remarks do need to be made concerning them.

"Palletized cargo" lines can be omitted from lines served by specialized vessels in the classification based on the technological characteristic (the mode of cargo shipment), since the shipment of palletized cargo and consolidated pieces of cargo is so widespread on general-purpose vessels that the characteristic "palletized" belongs rather to ordinary cargo lines and "trailer" lines ought to be referred to as "ro-ro" lines, indicating thereby that the trailers, trucks and other moving equipment are rolled on and off.

More precision is needed in the classification based on the organizational characteristic. For instance, in the discussion of groups of lines there is not only the term "joint," but also the term "bilateral," i.e., a line organized by two carriers to carry their mutual foreign trade. The Soviet-Bulgarian steamship line between Il'ichevsk and Varna would figure as such a line, for example.

"Conference" lines, which have a fuller meaning than "on the basis of the number of participants," should be put in a separate group "according to membership in a conference" along with the criteria of the "outsider" line and possibly the "loyal outsider" line as well. Then, for example, the BESTA and BaltKaPas (BMP) lines would be classified as wholly owned outsider lines, Baltamerika as a joint line, and Baltavstraliya as a wholly owned conference line.

The terms "pool" and "nonpool" line are missing from the classification, though these criteria could have a definite effect on organization of operation of the liner fleet.

Chapter 9 was unfortunately not finished--it does not contain a verification of the optimality conditions.

Nor have the questions of distribution of capital investments among the principal components of the technical facilities of line shipping been treated in sufficient detail; and further work is needed on the questions of improving the structure of management in shipping companies.

On the whole P. Panarin's book "Organizatsiya raboty lineynogo flota" will have a definite interest for specialists of shipping companies and ports, staff members of scientific research institutes, and teachers and students in higher educational institutions of the merchant marine.

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